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Quality we put forward

Name of Project : Construction of Bunding for Flood Protection of Adhiya River between SH20 and SH06 (from Chainage 8+589 to 11+786) – Phase II in Dholera Special Investment Region, Dholera.

Location : Adhiya River between SH20 and SH06 (from Chainage 8+589 to 11+786) – Phase II in Dholera Special Investment Region, Dholera.

Name of Client : Kalathiya Engineering and Construction Limited, Ahmedabad.

Project No. : 2022-23/GS-0005

Report No. : GS-0005-SBC-2022

Date of Report : 19.05.2022

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STRUCTURAL DESIGN SERVICES || CONSTRUCTION MATERIAL TESTING || GEOTECHNICAL INVESTIGATION
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Contents

1. INTRODUCTION

a. Project Information:

This report contains Geotechnical Investigation& SBC report for work **"Construction of Bunding for Flood Protection of Adhiya River between SH20 and SH06 (from Chainage 8+589 to 11+786) – Phase II in Dholera Special Investment Region, Dholera. Gujrat."**

b. Purpose of study:

The overall purpose of this study is to carry out the geotechnical investigation at the site, and to develop geotechnical recommendations for design and construction of foundations for the proposed project and associated facilities.

To accomplish these purposes, the study is being conducted in the following phases:

- Mobilization of necessary equipment and personnel to carry out all the works and demobilization after completing the work.
- Drilling boreholes to specified depths, in order to evaluate the stratigraphy, and to collect soil and groundwater samples for laboratory testing.
- Testing on selected soil samples in the laboratory to determine pertinent index and engineering properties; and analyzing all field and laboratory data to develop geotechnical recommendations for foundations.

The purpose, in brief of the proposed soil investigation is to ascertain the type of sub-strata, their characteristics and their suitability for the type of foundations and sub-structures to be adopted for the type and magnitude to envisaged loading.

2. FIELD WORK

- Exploratory boreholes drilling of 100/150mm dia. borehole by rotary drilling method.
- Carryout standard penetration test (SPT) at regular interval along with collection of samples.
- Collecting Undisturbed soil (UDS) samples and disturbed samples (DS) at desired interval in soil and core samples in rock formation and arranging them in sequence in core boxes of logging.
- Collecting ground water sample.

a. Drilling:

Drilling of 100/150 mm dia. borehole was carried out by rotary/Augur. Water was added while drilling but stopped at enough height above the test level to avoid disturbance. Casing is required to be lowered if holes do not retain its shape. Care is taken to maintain ground water table during drilling and particularly before testing or sampling levels. In no case casing is allowed to advance below the bottom of borehole. Chiseling is carried out if required while drilling. The Location of borehole was decided with due consideration of Client.

b. Collection of sample

Undisturbed soil samples in 76mm Ø Shelby tubes were collected in the thin walled sampling tubes in accordance with IS:2132-1981at regular interval for finding shear parameters, field density, moisture content etc. of soil. The sampling tube was connected to the rod by jarring link in case of 100mm Ø tubes. 'A' drill rods were connected by suitable adaptor with ball check value. Before lowering the sampler, the borehole was cleaned properly and sampling tubes were lightly oiled from inner and outer side.

Sampling tube was pushed into the borehole by pressure hammering as per the soil stiffness. The sampling tubes were waxed immediately after removal.

In case of medium to coarse grained, non-cohesive sand samples, where sampling is unsuccessful, Standard Penetration Tests was carried out after cleaning the borehole.

However, disturbed soil samples from shell or split spoon samplers were also collected in polythene bags with proper levels during drilling for finding index properties of the soil.

c. Standard Penetration Test:

The standard penetration tests were performed in accordance with IS: 2131:1981 using the standard split spoon sampler & 63.5Kg hammer at the desired intervals. Before testing, the borehole was cleaned properly and Split spoon sampler was centrally seated in the borehole. In case of SPT to be conducted below water table, care was taken to keep casing position above the borehole depth. The water level in borehole is maintained above or at least at the water table.

A standard hammer of 63.5 kg is dropped from a height of 75 cm. And the no. of blows for penetration of sampler for 0-15, 15-30 and 30-45 cm were noted in table no. Annexure-2. Standard penetration test value Ns is considered for last 30 cm penetration, for non-plastic silts and fine sands Ns value is corrected for effective overburden pressure and dilatancy. Correction is applied for tests conducted below water table.

d. Field investigation:

Field work includes the tests to be conducted on field as per relevant IS codes along with the Specification as detailed below:

- Exploratory boreholes using suitable accessories with collection of sample as guided by client.
- Conducting Standard Penetration Test (SPT) at desired intervals along with collection of samples.
- Collecting undisturbed samples (UDS) and disturbed samples (DS) at desired interval in soil and core samples in rock formation and arranging them in sequence in core boxes for logging.

3. LABORATORY TEST

Following laboratory tests were carried out on the sample collected from site;

Laboratory tests for soil samples,

Physical Analysis of Soil

	IS codes
Bulk density	By calculation
Natural moisture content	IS : 2720 (Part-2) – 1973
Grain size analysis	IS : 2720 (Part-4) – 1985
Liquid and Plastic Limits	IS : 2720 (Part-5) – 1985
Unconsolidated Undrained Tri-axial Shear Test	IS : 2720 (Part-11) – 1993
Consolidated Drained direct shear test	IS : 2720 (Part-13) – 1993

Chemical Analysis of Soil

Determination of pH value	IS : 2720 (Part-26) – 1987
Determination of total soluble sulphate	IS : 2720 (Part-27) – 1977

Chemical Analysis of Water

Determination of total soluble sulphate	IS : 3025 (Part-11) – 1996
Determination of chloride content	IS : 3025 (Part-24) – 1998
Determination of pH value	IS : 3025 (Part-32) – 1993

a. Grain size analysis:

Testing procedure generally confirms to IS: 2720 (Part 4) - 1985. Both sieve analysis and hydrometer analysis has been carried out.

Sieve Analysis: Sieve analysis for coarser fractions has been done by dry sieving, while wet sieving method has been followed for soil fractions with appreciable amount of clay. Sieving has been done using a sieve shaker by passing through the following IS sieves. 4.75mm, 2.36 mm, 1.70 mm, 1.40 mm, 1.00 mm, 600 microns, 425 microns, 100 microns and 75 microns.

b. Atterberg's Limits

Liquid Limit: Testing is done as per IS: 2720 (Part 5) 1985. About 200 gm of soil sample passing through 425 microns IS sieve is mixed thoroughly with distilled water on the flat glass to form a uniform paste. The paste generally has a consistency that will require 30 to 35 drops of the cup to cause the required closure of standard groove. The ready mix soil is placed in the Casagrande cup in such a way to form a depth of 1 cm at the center of the cup and then central groove of 12 mm is made using standard grooving tool. The cup is fitted and dropped by turning the crank at the rate of 2 revolutions per second until the two halves of the soil close. The number of drops required to make the groove close for the length of 12 mm is recorded. A portion of the sample is then taken out for water content determination and the water content corresponding to 25 blows represents the liquid limit.

Plastic Limit: About 15gms of oven dried soil passing through 425 microns' sieve is mixed with sufficient quantity of water such that the soil mass becomes plastic enough to be easily shaped into a ball. A portion of this ball is rolled on a glass plate with the palm of the hand into a thread of uniform dia of 3 mm. The water content represents the plastic limit.

c. Natural Moisture Content:

A moisture cup is loosely filled with soil and weighed with lid. It is then kept in oven with lid removed and maintained at temperature of the oven at 1100 C for 24 hours. The lid of the container is replaced and the dry weight found out. The percentage of water content shall be calculated using the formula.

$$W = \frac{W2 - W3}{W3 - W1} x100$$

Where,

W2= weight of container with wet soil, in g.

W3= weight of container with dry soil, in g

W1= weight of container with lid, in g

W= moisture content (%)

d. Bulk and Dry Density:

Test procedure shall be as per IS: 2720 (Part-7) – 1987. The unit weight of soil in g/cc is its weight per unit volume. Soil is filled in container and its weight determined. Knowing the volume of container, the ratio of weight to volume represents bulk density. The soil is then oven dried and weighed and dry density yd(g/cc) is computed using formula.

$$Yd = \frac{\text{Yb}}{(1 + \text{W})}$$

Where,

yb = bulk density in g/cc

W= natural moisture content in %.

e. Specific Gravity:

Test procedure shall be as per IS: 2720 (Part 3/ Section 1) – 1987 for fine-grained soils. The specific gravity of soil solids can be defined as the weight of given volume of soil particles to the weight of equal volume of distilled water. This term is used in relating weight of soil to its volume. Specific gravity is found out using standard specific gravity bottle of 50 ml capacity by weighing empty bottle (w1), bottle+ dry soil (w2), bottle + dry soil + water (w3), bottle + water (w4).

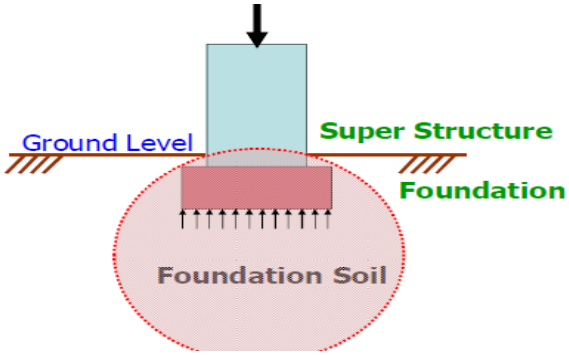
$$G = \frac{(W_2 - W_1)}{((W_2 - W_1) - (W_3 - W_4))}$$

f. Direct Shear Test:

Test procedure shall be as per IS: 2720 (Part 13). In this test the soil specimen is confined in a square metal box split into two halves horizontally. Perforated metal plates and pores stones are placed above and below the specimen to allow free drainage. After applying vertical load the soil is gradually sheared by applying horizontal force, which makes the two halves of the box move relative to each other. The shear is applied at a constant strain rate and measured in a proving ring. Vertical deformation is measured with dial gauge. Minimum of three specimens are tested and the graph drawn with normal stress in ‘X’ axis and shear stress in ‘Y’ axis. From the straight line plot, values of C and Φ are measured.

4. BEARING CAPACITY OF SOIL

Bearing capacity is the power of foundation soil to hold the forces from the superstructure without undergoing shear failure or excessive settlement. Foundation soil is that portion of ground which is subjected to additional stresses when foundation and superstructure are constructed on the ground. The following are a few important terminologies related to bearing capacity of soil.



a. Ultimate Bearing Capacity (qf):

It is the maximum pressure that a foundation soil can withstand without undergoing shear failure.

b. Net ultimate Bearing Capacity (qn):

It is the maximum extra pressure (in addition to initial overburden pressure) that a foundation soil can withstand without undergoing shear failure.

$$q_n = q_f - q_o$$

Here, qo represents the overburden pressure at foundation level and is equal to γD for level ground without surcharge where γ is the unit weight of soil and D is the depth to foundation bottom from Ground Level.

c. Safe Bearing Capacity (qs):

It is the safe extra load the foundation soil is subjected to in addition to initial overburden pressure.

$$q_s = \frac{q_n}{F} - q_o$$

Here F represents the factor of safety

d. Allowable Bearing Pressure (qa):

It is the maximum pressure the foundation soil is subjected to considering both shear failure and settlement.

e. Foundation:

Is that part of the structure which is in direct contact with soil. Foundation transfers the forces and moments from the super structure to the soil below such that the stresses in soil are within permissible limits and it provides stability against sliding and overturning to the super structure. It is a transition between the super structure and foundation soil. The job of a geotechnical engineer is to ensure that both foundation and soil below are safe against failure and do not experience excessive settlement. Footing and foundation are synonymous.

Concept:

A strip footing of width B gradually compresses the foundation soil underneath due to the vertical load from superstructure. Let qf be the final load at which the foundation soil experiences failure due to the mobilization of plastic equilibrium. The foundation soil fails along the composite failure surface and the region is divided in to five zones, Zone 1 which is elastic, two numbers of Zone 2 which are the zones of radial shear and two zones of Zone 3 which are the zones of linear shear. Considering horizontal force equilibrium and incorporating empirical relation, **the equation for ultimate bearing capacity is obtained as follows.**

$$Ultimate\ bearing\ capacity = cN_c + YDN_q + 0.5YBN_Y$$

If the ground is subjected to additional surcharge load q,

$$q_f = cN_c + (YD - q)N_q + 0.5YBN_Y$$

Net ultimate bearing capacity,

$$q_n = cN_c + YD(N_q - 1) + 0.5YBN_Y$$

Safe bearing capacity,

$$q_s = \left[cN_c + YD\left(N_q - 1\right) + 0.5YBN_Y\right]\frac{1}{F} + YD$$

Here,

F = Factor of safety (usually 2.5)

c = cohesion γ = unit weight of soil

D = Depth of foundation

q = Surcharge at the ground level

B = Width of foundation

Nc, Nq, Nγ = Bearing Capacity factors

f. Effect of Water Table fluctuation:

The basic theory of bearing capacity is derived by assuming the water table to be at great depth below and not interfering with the foundation. However, the presence of water table at foundation depth affects the strength of soil. Further, the unit weight of soil to be considered in the presence of water table is submerged density and not dry density. Hence, the reduction coefficients RW1 and RW2 are used in second and third terms of bearing capacity equation to consider the effects of water table.

g. Factors influencing Bearing Capacity:

Bearing capacity of soil depends on many factors. The following are some important ones.

- Type of soil
- Unit weight of soil
- Surcharge load
- Depth of foundation
- Mode of failure
- Size of footing
- Shape of footing
- Depth of water table
- Eccentricity in footing load
- Inclination of footing load
- Inclination of ground
- Inclination of base of foundation

h. Settlement of foundation on cohesion less soils.

Settlement of a footing of width B under unit intensity of pressure resting on dry cohesion less deposit with known standard penetration resistance value N, (determined according to IS: 2131), may be read from Fig. 9 of IS:8009-Part-I.

5. DISCUSSION AND RECOMMENDATION

The location of boreholes along with its details is tabulated below: -

Sr No	Bore Hole Marking	Chainage/Location	Coordinate	R.L of the Boreholes	Termination details	
					Depth (Mt)	RL (Mt)
1	BH-01	CH: 9+560 RHS	-	-	10.0	-
2	BH-02	CH: 10+090 RHS	-	-	10.0	-
3	BH-03	CH: 10+620 RHS	-	-	10.0	-
4	BH-04	CH: 11+150 RHS	-	-	10.0	-
5	BH-05	CH: 11+140 LHS	-	-	10.0	-
6	BH-06	CH: 10+580 LHS	-	-	10.0	-
7	BH-07	CH: 10+020 LHS	-	-	10.0	-

a. Soil Stratifications

Refer Annexure-5 Bore logs for Different Stratifications of soil.

b. Ground water table

Ground water was encountered near 2.0mtr depth on each borehole of total 10.00mtr Depth at the time of investigation. (May-2022)

c. Structural fill/Site Grading

Any existing surface vegetation should be removed from the area prior to any site grading. Compacted structural fill, should consist of non-expansive soils, free of organics and rubble. Fill at this site should be placed in layers of maximum loose thickness of 150 mm and compacted to a minimum of 95 percent of its maximum dry density as determined by the Standard Proctor Test. Existing soils at this site are suitable for use as compacted structural fill or for site grading backfill. However, if existing silty soils are utilized as compacted fill, a minimum cover of 0.5m of any soils with predominant sand or clay, should be provided to prevent erosion. Any permanent exposed slopes above high groundwater level should be sloped at 2:1 (horizontal: vertical). Erosion protection in the form of stone masonry should be provided on exposed slopes. Permanent excavations below water table should not be conducted.

d. Liquefaction Susceptibility Analysis

Liquefaction is defined as the transformation of a granular material from a solid to a liquefied state as a consequence of increased pore-water pressure and reduced effective stress (Marcuson, 1978) Increased pore pressure may be induced by the tendency of granular materials to compact when subjected to cyclic shear deformation, such as in the event of an earthquake.

As per IS: 1893 (part-1)-2002, Table-1 liquefaction is likely in loose fine sands below water table.

The following points are noted for the soils encountered at the site, with reference to the liquefaction susceptibility analysis;

- The soil at the site generally consists of Silty to Clayey/Silty Sand about 10.0 mtr depth. Since Liquefaction usually occurs in 'clean' loose granular soils (such as fine sands) below groundwater table as a consequence of increased pore water pressure during earthquakes, the potential for liquefaction in this stratum is low.
- The sand strata encountered at the site is dense to medium dense in consistency, with SPT N-values greater than the limits prescribed by the IS code for liquefaction susceptibility.
- Based on a review of all soil parameters like in-situ density, ground water levels, fines content, SPT values etc. we are of the opinion that liquefaction is not likely to take place at the site in the event of a major earthquake.
- The structure should be designed as per Seismic zone – III, according to IS1893:2002.

e. Conclusion & Recommendations

The bore log indicates that a sub-soil stratum at the site consist predominantly of Silty to Clayey Sand(SC/SM) & Sandy Clay (CL/CI) as discussed in soil stratification.

"N" Value	0-2	2-4	4-8	8-15	15-30	>30
Consistency	Very Soft	Soft	Medium	Stiff	Very Stiff	Hard

"N" Value	0-4	4-10	10-30	30-50	>50
Denseness	Very Loose	Loose	Medium	Dense	Very Dense

The SPT logs are presented in Annexure-5 & in respective bore logs. SPT values at different depths shows that the SPT value increases with depth.

- Safe bearing capacity of isolated square footing of various widths at various depths are recommended in Appendix-1 based on Shear and settlement criteria of soil. The recommended value of SBC shall be for static vertical load only.
- Considering physical/Engineering properties of soil and laboratory test Report **"Open Foundation"** is suggested for this site. Safe bearing capacity of isolated footings of various widths and various depths are recommended in Appendix- 1 to 4 based on shear and settlement criteria.

- The findings and recommendations are further based on the assumption that the subsurface conditions do not deviate appreciably from those reported and those assumed. The potential for encountering conditions different from those assumed can never be discounted. We have performed according to generally accepted geotechnical engineering practices followed in the project area at the time the services were provided. No warranty is expressed or implied.
- The findings and the recommendations presented in this report are based upon soil conditions inferred from site explorations, interpolation of the soil conditions between exploration conditions throughout the proposed area. The extent of the investigation as well as specific explorations locations were dictated by client.

6. ABBREVIATIONS

C	Cohesion	**PL**	Plastic Limit
DS	Disturbed Sample	**PI**	Plasticity Index
UDS	Undisturbed Sample	**NP**	Non Plastic
SPT	Standard Penetration Test	**DST**	Direct Shear Unconsolidated Undrain Test
GWT	Ground Water Table	**SC**	Clayey Sand
EGL	Existing Ground Level	**SM**	Silty Sand
BH	Borehole	**SP-SM**	Poorly Graded Silty Sand
FOS	Factor of Safety	**CL**	Silty Clay Having Low Plasticity
Γ	Density of Soil	**CI**	Silty Clay Having Medium Plasticity
LL	Liquid Limit	**FS**	Filled up Soil

ANNEXTURE-01

Summary of Allowable bearing Capacity based on Shear & Settlement Criteria

Summary of Allowable bearing Capacity based on Shear & Settlement Criteria

Borehole No	Depth of Foundation	Width of Foundation	Length of Foundation	Net Safe bearing Capacity (C-Phi)	Safe Bearing Pressure (SPT)	Allowable bearing Capacity suggested
	(Mt)	(Mt)	(Mt)	(T/m^2)	(T/m^2)	(T/m^2)
BH-01	1.0	3.00	3.00	8.91	2.80	**2.80**
	2.0	3.00	3.00	14.60	4.60	**4.60**
	3.0	3.00	3.00	20.59	8.30	**8.30**
	4.0	3.00	3.00	22.64	9.80	**9.80**
	5.0	3.00	3.00	28.56	27.50	**27.50**
	6.0	3.00	3.00	34.86	29.00	**29.00**
BH-02	1.0	3.00	3.00	6.63	2.90	**2.90**
	2.0	3.00	3.00	10.46	5.60	**5.60**
	3.0	3.00	3.00	11.67	7.60	**7.60**
	4.0	3.00	3.00	19.67	10.00	**10.00**
	5.0	3.00	3.00	24.18	11.50	**11.50**
	6.0	3.00	3.00	44.25	12.70	**12.70**
BH-03	1.0	3.00	3.00	5.04	2.90	**2.90**
	2.0	3.00	3.00	7.54	3.70	**3.70**
	3.0	3.00	3.00	10.10	10.00	**10.00**
	4.0	3.00	3.00	55.31	10.00	**10.00**
	5.0	3.00	3.00	70.36	26.30	**26.30**
	6.0	3.00	3.00	86.47	27.80	**27.80**

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BH-04	1.0	3.00	3.00	4.64	5.00	**4.64**
	2.0	3.00	3.00	6.85	5.60	**5.60**
	3.0	3.00	3.00	17.29	8.00	**8.00**
	4.0	3.00	3.00	22.65	12.50	**12.50**
	5.0	3.00	3.00	74.46	15.20	**15.20**
	6.0	3.00	3.00	91.49	16.70	**16.70**
BH-05	1.0	3.00	3.00	6.28	3.10	**3.10**
	2.0	3.00	3.00	9.53	3.90	**3.90**
	3.0	3.00	3.00	12.10	10.30	**10.30**
	4.0	3.00	3.00	15.43	11.80	**11.80**
	5.0	3.00	3.00	84.02	19.30	**19.30**
	6.0	3.00	3.00	101.74	20.80	**20.80**
BH-06	1.0	3.00	3.00	7.63	7.00	**7.00**
	2.0	3.00	3.00	12.06	8.00	**8.00**
	3.0	3.00	3.00	46.89	12.50	**12.50**
	4.0	3.00	3.00	62.57	14.00	**14.00**
	5.0	3.00	3.00	82.96	24.80	**24.80**
	6.0	3.00	3.00	101.92	27.80	**27.80**
BH-07	1.0	3.00	3.00	4.31	5.00	**4.31**
	2.0	3.00	3.00	8.75	6.50	**6.50**
	3.0	3.00	3.00	15.06	26.40	**15.06**
	4.0	3.00	3.00	27.51	27.90	**27.51**
	5.0	3.00	3.00	34.53	29.40	**29.40**
	6.0	3.00	3.00	117.44	29.40	**29.40**

ANNEXTURE-02

Borehole Wise SPT

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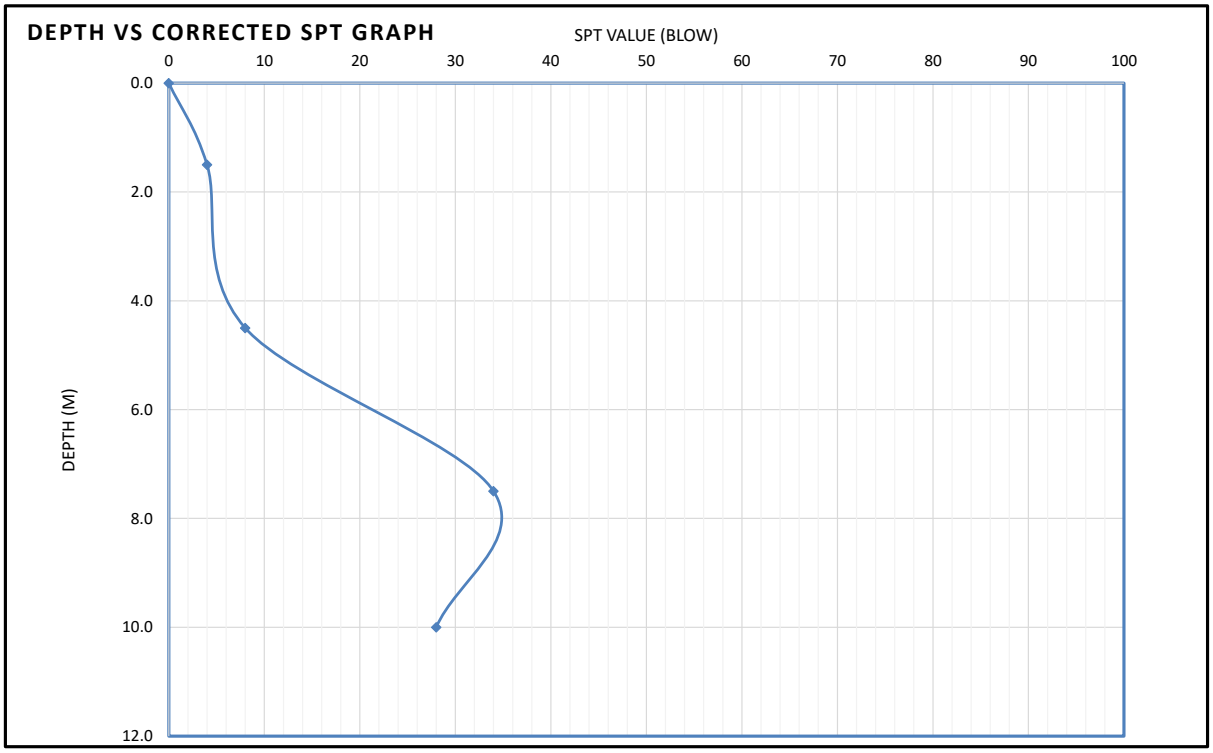
Summary of SPT Values

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

SPT values for Borehole

Sr no	Coordinates/ Location	Borehole Marking	Depth (m)	Observed SPT-N value (N)	Corrected-N Value (N)	Bulk density (kN/m^3)	Overburden Pressure (kN/m^2)
1	-	BH-01	0.0	0	0	16.95	0.00
			1.5	3	4		25.43
			4.5	7	8		76.28
			7.5	56	34		127.13
			10.0	50	28		169.50

1) SPT corrections are applied as per IS-2131.



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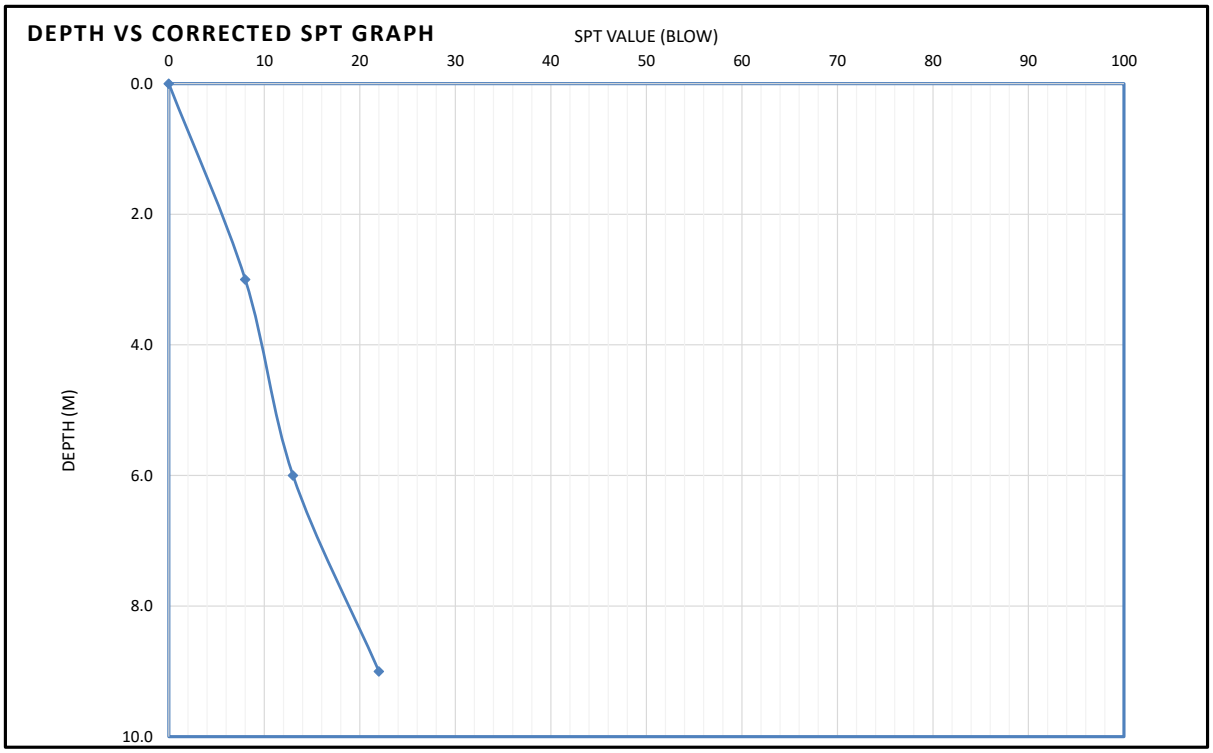
Summary of SPT Values

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

SPT values for Borehole

Sr no	Coordinates/ Location	Borehole Marking	Depth (m)	Observed SPT-N value (N)	Corrected-N Value (N)	Bulk density (kN/m^3)	Overburden Pressure (kN/m^2)
1	-	BH-02	0.0	0	0	17.02	0.00
			3.0	7	8		51.06
			6.0	13	13		102.12
			9.0	33	22		153.18

1) SPT corrections are applied as per IS-2131.



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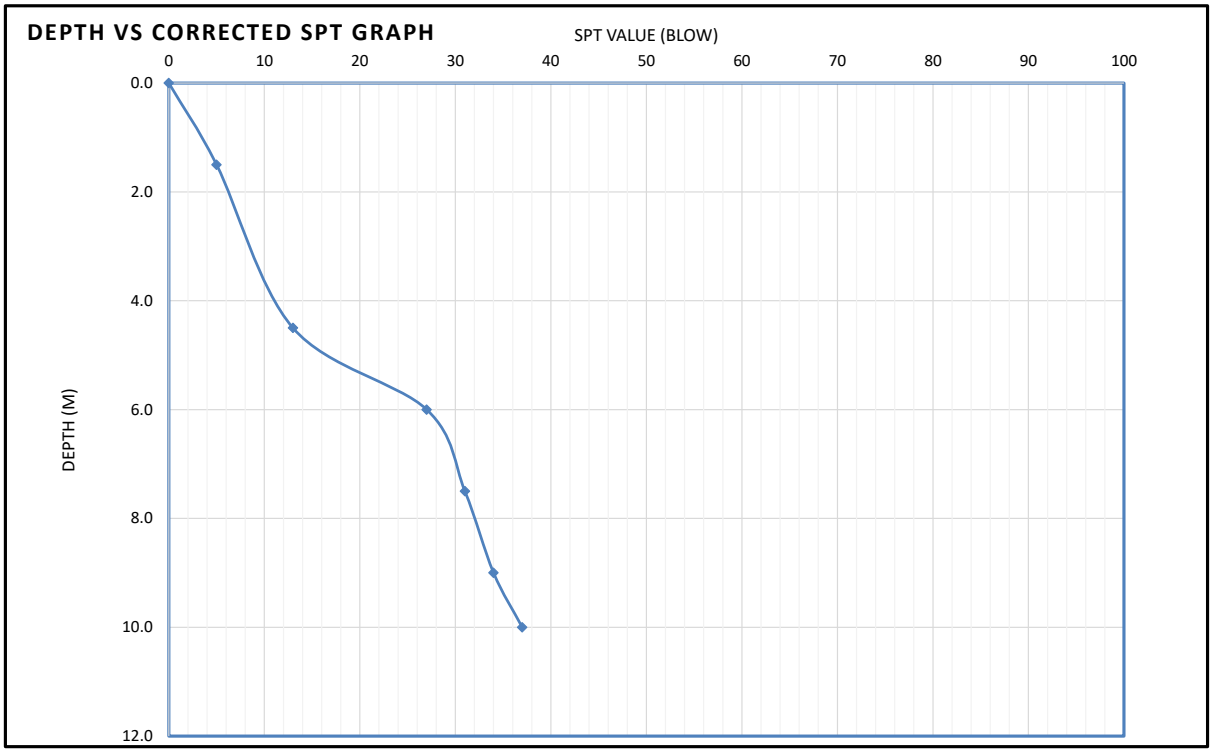
Summary of SPT Values

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

SPT values for Borehole

Sr no	Coordinates/ Location	Borehole Marking	Depth (m)	Observed SPT-N value (N)	Corrected-N Value (N)	Bulk density (kN/m^3)	Overburden Pressure (kN/m^2)
1	-	BH-03	0.0	0	0	17.35	0.00
			1.5	4	5		26.03
			4.5	12	13		78.08
			6.0	39	27		104.10
			7.5	51	31		130.13
			9.0	62	34		156.15
			10.0	72	37		173.50

1) SPT corrections are applied as per IS-2131.



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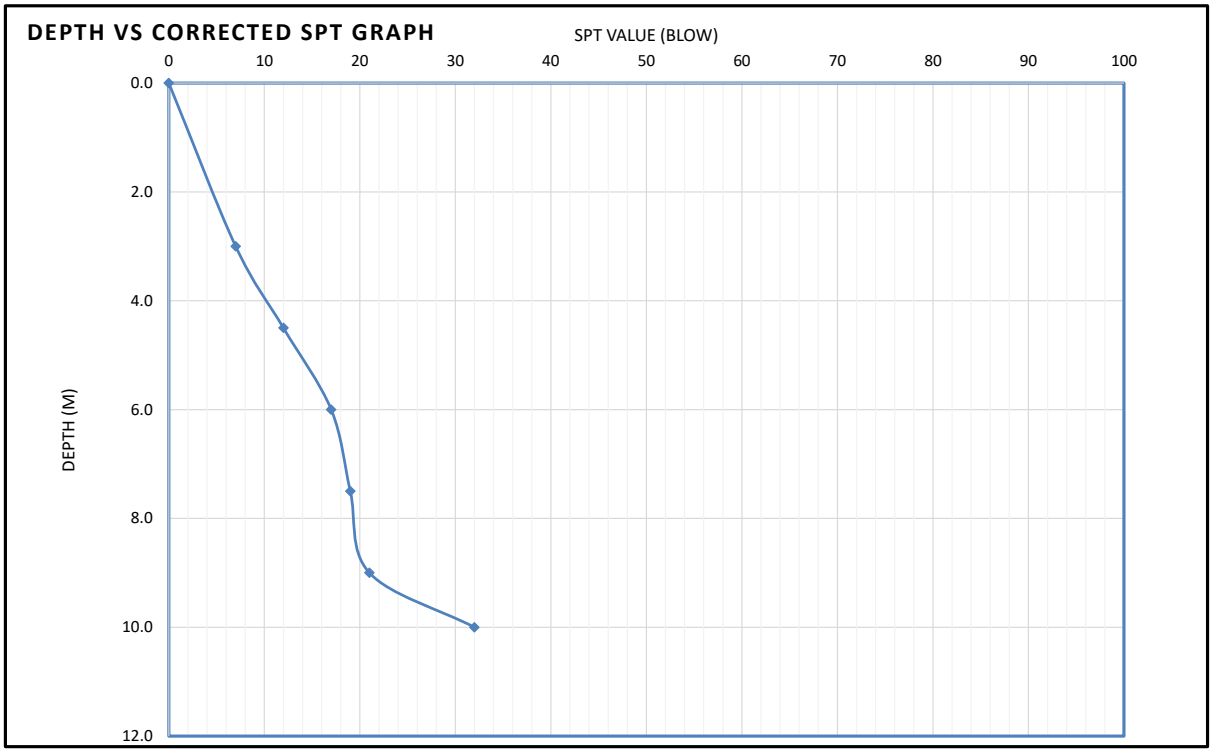
Summary of SPT Values

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

SPT values for Borehole

Sr no	Coordinates/ Location	Borehole Marking	Depth (m)	Observed SPT-N value (N)	Corrected-N Value (N)	Bulk density (kN/m^3)	Overburden Pressure (kN/m^2)
1	-	BH-04	0.0	0	0	16.38	0.00
			3.0	6	7		49.14
			4.5	11	12		73.71
			6.0	19	17		98.28
			7.5	25	19		122.85
			9.0	31	21		147.42
			10.0	59	32		163.80

1) SPT corrections are applied as per IS-2131.



GOMA ENGINEERING AND CONSULTANCY

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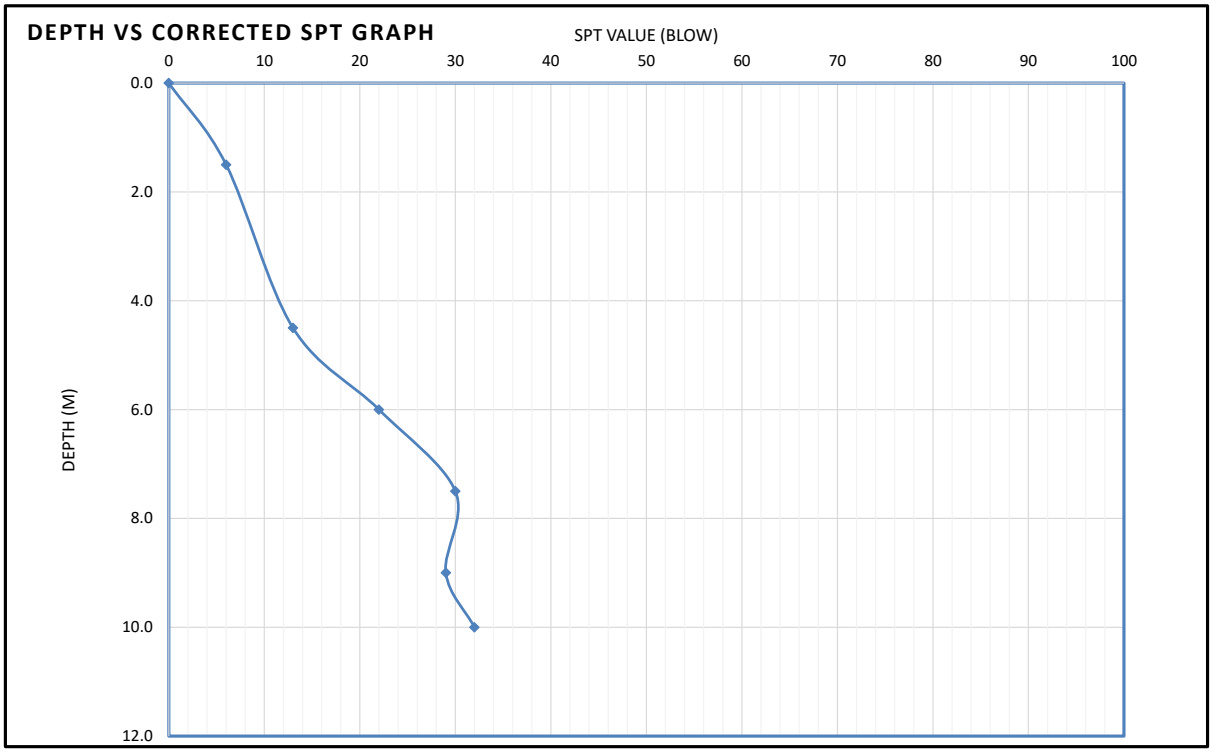
Summary of SPT Values

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

SPT values for Borehole

Sr no	Coordinates/ Location	Borehole Marking	Depth (m)	Observed SPT-N value (N)	Corrected-N Value (N)	Bulk density (kN/m^3)	Overburden Pressure (kN/m^2)
1	-	BH-05	0.0	0	0	16.44	0.00
			1.5	4	6		24.66
			4.5	12	13		73.98
			6.0	29	22		98.64
			7.5	47	30		123.30
			9.0	48	29		147.96
			10.0	59	32		164.40

1) SPT corrections are applied as per IS-2131.



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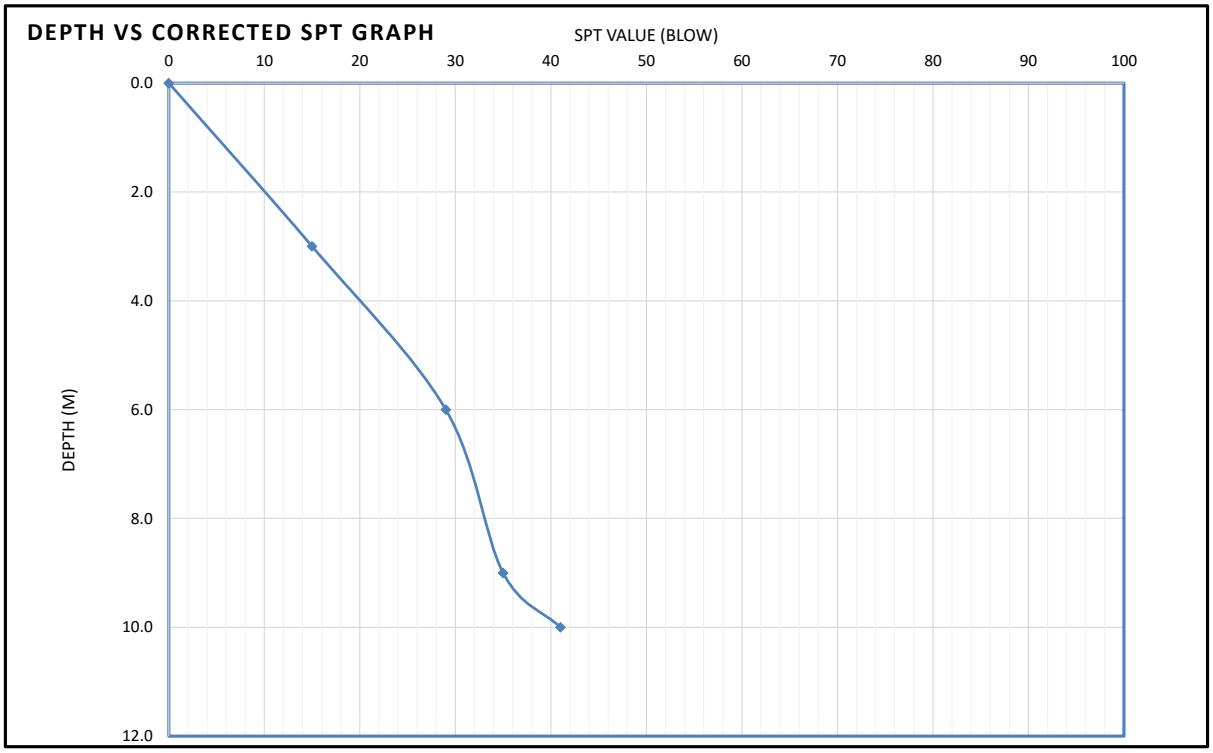
Summary of SPT Values

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

SPT values for Borehole

Sr no	Coordinates/ Location	Borehole Marking	Depth (m)	Observed SPT-N value (N)	Corrected-N Value (N)	Bulk density (kN/m^3)	Overburden Pressure (kN/m^2)
1	-	BH-06	0.0	0	0	17.90	0.00
			3.0	13	15		53.70
			6.0	43	29		107.40
			9.0	65	35		161.10
			10.0	83	41		179.00

1) SPT corrections are applied as per IS-2131.



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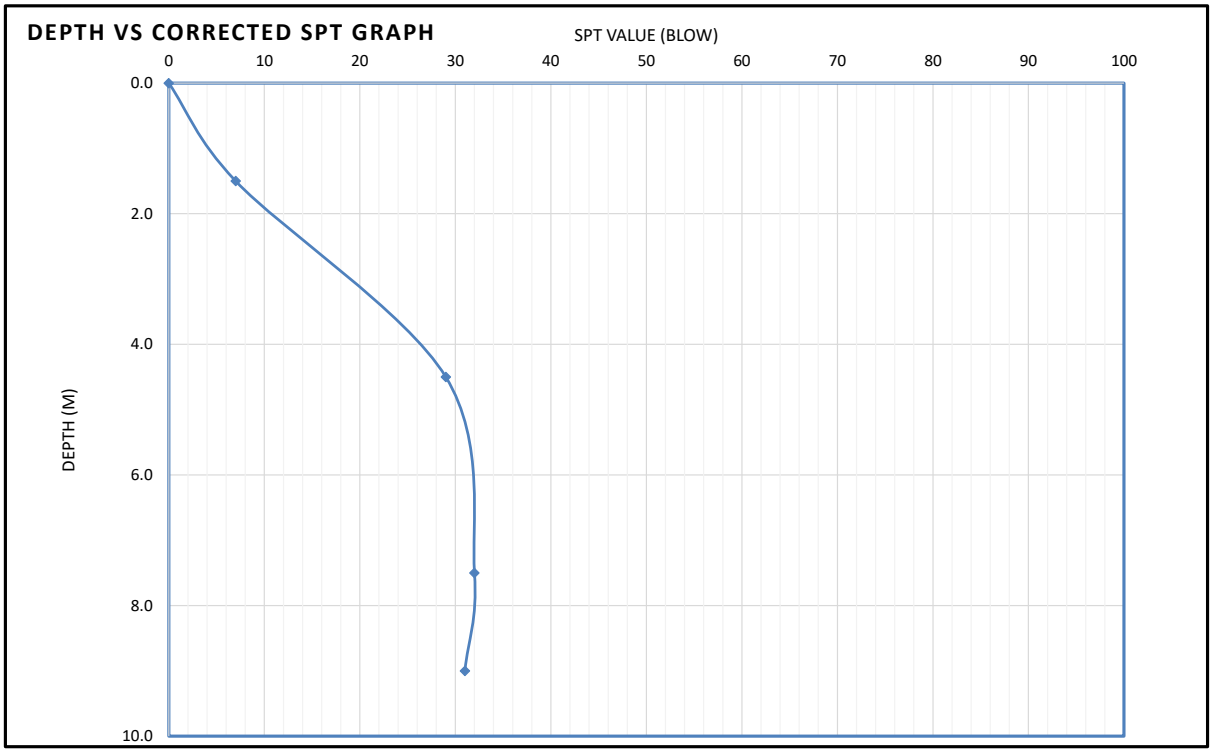
Summary of SPT Values

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

SPT values for Borehole

Sr no	Coordinates/ Location	Borehole Marking	Depth (m)	Observed SPT-N value (N)	Corrected-N Value (N)	Bulk density (kN/m^3)	Overburden Pressure (kN/m^2)
1	-	BH-07	0.0	0	0	17.48	0.00
			1.5	5	7		26.22
			4.5	39	29		78.66
			7.5	53	32		131.10
			9.0	54	31		157.32
			10.0	84	42		174.80

1) SPT corrections are applied as per IS-2131.



GOMA ENGINEERING AND CONSULTANCY

ANNEXTURE-03

Summary of Allowable bearing Capacity based on C-Ø Criteria

BH-01

Calculation of Net Safe Bearing Capacity based on C - Φ parameters

As per IS-6403:1981

Project	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

GENERAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	1.96	21.20	16.24	7.42	6.71	1.30	1.20	0.80	1.10	1.05	1.05	1.00	1.00	1.00	16.95	8.48	1.00	0.50	10.16	11.96
2	3.00	3.00	2.00	1.96	21.20	16.24	7.42	6.71	1.30	1.20	0.80	1.19	1.10	1.10	1.00	1.00	1.00	16.95	8.48	1.00	0.50	16.76	20.36
3	3.00	3.00	3.00	1.96	21.20	16.24	7.42	6.71	1.30	1.20	0.80	1.29	1.15	1.15	1.00	1.00	1.00	16.95	8.48	1.00	0.50	23.69	29.09
4	3.00	3.00	4.00	0.00	25.30	21.29	11.12	11.57	1.30	1.20	0.80	1.42	1.21	1.21	1.00	1.00	1.00	16.95	8.48	1.00	0.50	46.48	53.68
5	3.00	3.00	5.00	0.00	25.30	21.29	11.12	11.57	1.30	1.20	0.80	1.53	1.26	1.26	1.00	1.00	1.00	16.95	8.48	1.00	0.50	59.11	68.11
6	3.00	3.00	6.00	0.00	25.30	21.29	11.12	11.57	1.30	1.20	0.80	1.63	1.32	1.32	1.00	1.00	1.00	16.95	8.48	1.00	0.50	72.63	83.43

LOCAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	1.31	14.57	10.75	3.81	2.53	1.30	1.20	1.20	1.09	1.04	1.04	1.00	1.00	1.00	16.95	8.48	1.00	0.50	4.88	6.68
2	3.00	3.00	2.00	1.31	14.57	10.75	3.81	2.53	1.30	1.20	1.20	1.17	1.09	1.09	1.00	1.00	1.00	16.95	8.48	1.00	0.50	7.65	11.25
3	3.00	3.00	3.00	1.31	14.57	10.75	3.81	2.53	1.30	1.20	1.20	1.26	1.13	1.13	1.00	1.00	1.00	16.95	8.48	1.00	0.50	10.62	16.02
4	3.00	3.00	4.00	0.00	17.57	12.96	5.21	4.06	1.30	1.20	1.20	1.36	1.18	1.18	1.00	1.00	1.00	16.95	8.48	1.00	0.50	19.49	26.69
5	3.00	3.00	5.00	0.00	17.57	12.96	5.21	4.06	1.30	1.20	1.20	1.46	1.23	1.23	1.00	1.00	1.00	16.95	8.48	1.00	0.50	24.52	33.52
6	3.00	3.00	6.00	0.00	17.57	12.96	5.21	4.06	1.30	1.20	1.20	1.55	1.27	1.27	1.00	1.00	1.00	16.95	8.48	1.00	0.50	29.87	40.67

> As Per IS 6403 : 1981, Table - 03 Mix Shear Failure

Note:-

1) Factor of safety of 2.5 is considered.

2) The depth of foundation is considered from the NGL.

3) Ultimate net safe bearing capapcity is evaluated after taking into consideration shape factor,depth factor of foundation in accordance with IS-6403-1981.

BH-02

Calculation of Net Safe Bearing Capacity based on C - Φ parameters

As per IS-6403:1981

Project	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

GENERAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	2.94	16.20	11.90	4.53	3.31	1.30	1.20	0.80	1.09	1.04	1.04	1.00	1.00	1.00	17.02	8.51	1.00	0.50	6.40	8.20
2	3.00	3.00	2.00	2.94	16.20	11.90	4.53	3.31	1.30	1.20	0.80	1.18	1.09	1.09	1.00	1.00	1.00	17.02	8.51	1.00	0.50	10.09	13.69
3	3.00	3.00	3.00	2.94	16.20	11.90	4.53	3.31	1.30	1.20	0.80	1.27	1.13	1.13	1.00	1.00	1.00	17.02	8.51	1.00	0.50	13.91	19.31
4	3.00	3.00	4.00	1.96	21.90	17.07	8.02	7.48	1.30	1.20	0.80	1.39	1.20	1.20	1.00	1.00	1.00	17.02	8.51	1.00	0.50	34.21	41.41
5	3.00	3.00	5.00	1.96	21.90	17.07	8.02	7.48	1.30	1.20	0.80	1.49	1.25	1.25	1.00	1.00	1.00	17.02	8.51	1.00	0.50	42.98	51.98
6	3.00	3.00	6.00	0.00	26.10	22.79	12.36	13.41	1.30	1.20	0.80	1.64	1.32	1.32	1.00	1.00	1.00	17.02	8.51	1.00	0.50	82.39	93.19

LOCAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	1.96	11.02	8.88	2.77	1.51	1.30	1.20	1.20	1.08	1.04	1.04	1.00	1.00	1.00	17.02	8.51	1.00	0.50	3.51	6.01
2	3.00	3.00	2.00	1.96	11.02	8.88	2.77	1.51	1.30	1.20	1.20	1.16	1.08	1.08	1.00	1.00	1.00	17.02	8.51	1.00	0.50	5.28	10.28
3	3.00	3.00	3.00	1.96	11.02	8.88	2.77	1.51	1.30	1.20	1.20	1.24	1.12	1.12	1.00	1.00	1.00	17.02	8.51	1.00	0.50	7.16	14.66
4	3.00	3.00	4.00	1.31	15.07	11.04	3.98	2.69	1.30	1.20	1.20	1.35	1.17	1.17	1.00	1.00	1.00	17.02	8.51	1.00	0.50	14.65	24.65
5	3.00	3.00	5.00	1.31	15.07	11.04	3.98	2.69	1.30	1.20	1.20	1.43	1.22	1.22	1.00	1.00	1.00	17.02	8.51	1.00	0.50	18.24	30.74
6	3.00	3.00	6.00	0.00	18.17	13.42	5.50	4.39	1.30	1.20	1.20	1.55	1.28	1.28	1.00	1.00	1.00	17.02	8.51	1.00	0.50	32.20	47.20

> As Per IS 6403 : 1981, Table - 03 Mix Shear Failure

Note:-

1) Factor of safety of 2.5 is considered.

2) The depth of foundation is considered from the NGL.

3) Ultimate net safe bearing capapcity is evaluated after taking into consideration shape factor,depth factor of foundation in accordance with IS-6403-1981.

BH-03

Calculation of Net Safe Bearing Capacity based on C - Φ parameters

As per IS-6403:1981

Project	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

GENERAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	3.92	12.40	9.61	3.18	1.91	1.30	1.20	0.80	1.08	1.04	1.04	1.00	1.00	1.00	17.35	8.68	1.00	0.50	4.84	6.64
2	3.00	3.00	2.00	3.92	12.40	9.61	3.18	1.91	1.30	1.20	0.80	1.17	1.08	1.08	1.00	1.00	1.00	17.35	8.68	1.00	0.50	7.21	10.81
3	3.00	3.00	3.00	3.92	12.40	9.61	3.18	1.91	1.30	1.20	0.80	1.25	1.12	1.12	1.00	1.00	1.00	17.35	8.68	1.00	0.50	9.64	15.04
4	3.00	3.00	4.00	0.00	25.90	22.42	12.05	12.95	1.30	1.20	0.80	1.43	1.21	1.21	1.00	1.00	1.00	17.35	8.68	1.00	0.50	52.21	59.41
5	3.00	3.00	5.00	0.00	25.90	22.42	12.05	12.95	1.30	1.20	0.80	1.53	1.27	1.27	1.00	1.00	1.00	17.35	8.68	1.00	0.50	66.39	75.39
6	3.00	3.00	6.00	0.00	25.90	22.42	12.05	12.95	1.30	1.20	0.80	1.64	1.32	1.32	1.00	1.00	1.00	17.35	8.68	1.00	0.50	81.57	92.37

LOCAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	2.61	8.38	7.75	2.18	0.97	1.30	1.20	1.20	1.08	1.00	1.00	1.00	1.00	1.00	17.35	8.68	1.00	0.50	2.78	5.28
2	3.00	3.00	2.00	2.61	8.38	7.75	2.18	0.97	1.30	1.20	1.20	1.15	1.00	1.00	1.00	1.00	1.00	17.35	8.68	1.00	0.50	3.86	8.86
3	3.00	3.00	3.00	2.61	8.38	7.75	2.18	0.97	1.30	1.20	1.20	1.23	1.00	1.00	1.00	1.00	1.00	17.35	8.68	1.00	0.50	4.94	12.44
4	3.00	3.00	4.00	0.00	18.02	13.31	5.43	4.31	1.30	1.20	1.20	1.37	1.18	1.18	1.00	1.00	1.00	17.35	8.68	1.00	0.50	21.04	31.04
5	3.00	3.00	5.00	0.00	18.02	13.31	5.43	4.31	1.30	1.20	1.20	1.46	1.23	1.23	1.00	1.00	1.00	17.35	8.68	1.00	0.50	26.48	38.98
6	3.00	3.00	6.00	0.00	18.02	13.31	5.43	4.31	1.30	1.20	1.20	1.55	1.28	1.28	1.00	1.00	1.00	17.35	8.68	1.00	0.50	32.26	47.26

> As Per IS 6403 : 1981, Table - 03 Mix Shear Failure

Note:-

1) Factor of safety of 2.5 is considered.

2) The depth of foundation is considered from the NGL.

3) Ultimate net safe bearing capapcity is evaluated after taking into consideration shape factor,depth factor of foundation in accordance with IS-6403-1981.

BH-04

Calculation of Net Safe Bearing Capacity based on C - Φ parameters

As per IS-6403:1981

Project Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

GENERAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	3.92	13.50	10.19	3.50	2.22	1.30	1.20	0.80	1.08	1.04	1.04	1.00	1.00	1.00	16.38	8.19	1.00	0.50	5.21	7.01
2	3.00	3.00	2.00	3.92	13.50	10.19	3.50	2.22	1.30	1.20	0.80	1.17	1.08	1.08	1.00	1.00	1.00	16.38	8.19	1.00	0.50	7.79	11.39
3	3.00	3.00	3.00	1.96	19.40	14.37	6.10	5.06	1.30	1.20	0.80	1.28	1.14	1.14	1.00	1.00	1.00	16.38	8.19	1.00	0.50	18.24	23.64
4	3.00	3.00	4.00	1.96	19.40	14.37	6.10	5.06	1.30	1.20	0.80	1.38	1.19	1.19	1.00	1.00	1.00	16.38	8.19	1.00	0.50	23.92	31.12
5	3.00	3.00	5.00	0.00	27.20	24.86	14.07	15.95	1.30	1.20	0.80	1.55	1.27	1.27	1.00	1.00	1.00	16.38	8.19	1.00	0.50	74.82	83.82
6	3.00	3.00	6.00	0.00	27.20	24.86	14.07	15.95	1.30	1.20	0.80	1.66	1.33	1.33	1.00	1.00	1.00	16.38	8.19	1.00	0.50	91.93	102.73

LOCAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	2.61	9.14	8.03	2.31	1.09	1.30	1.20	1.20	1.08	1.00	1.00	1.00	1.00	1.00	16.38	8.19	1.00	0.50	2.91	5.41
2	3.00	3.00	2.00	2.61	9.14	8.03	2.31	1.09	1.30	1.20	1.20	1.16	1.00	1.00	1.00	1.00	1.00	16.38	8.19	1.00	0.50	4.05	9.05
3	3.00	3.00	3.00	1.31	13.28	10.07	3.43	2.16	1.30	1.20	1.20	1.25	1.13	1.13	1.00	1.00	1.00	16.38	8.19	1.00	0.50	8.93	16.43
4	3.00	3.00	4.00	1.31	13.28	10.07	3.43	2.16	1.30	1.20	1.20	1.34	1.17	1.17	1.00	1.00	1.00	16.38	8.19	1.00	0.50	11.57	21.57
5	3.00	3.00	5.00	0.00	19.00	14.06	5.91	4.84	1.30	1.20	1.20	1.47	1.23	1.23	1.00	1.00	1.00	16.38	8.19	1.00	0.50	27.86	40.36
6	3.00	3.00	6.00	0.00	19.00	14.06	5.91	4.84	1.30	1.20	1.20	1.56	1.28	1.28	1.00	1.00	1.00	16.38	8.19	1.00	0.50	33.96	48.96

> As Per IS 6403 : 1981, Table - 03 Mix Shear Failure

Note:-

1) Factor of safety of 2.5 is considered.

2) The depth of foundation is considered from the NGL.

3) Ultimate net safe bearing capapcity is evaluated after taking into consideration shape factor,depth factor of foundation in accordance with IS-6403-1981.

BH-05

Calculation of Net Safe Bearing Capacity based on C - Φ parameters

As per IS-6403:1981

Project	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

GENERAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	3.92	14.60	10.77	3.82	2.54	1.30	1.20	0.80	1.09	1.04	1.04	1.00	1.00	1.00	16.44	8.22	1.00	0.50	5.75	7.55
2	3.00	3.00	2.00	3.92	14.60	10.77	3.82	2.54	1.30	1.20	0.80	1.17	1.09	1.09	1.00	1.00	1.00	16.44	8.22	1.00	0.50	8.67	12.27
3	3.00	3.00	3.00	3.92	15.00	10.98	3.94	2.65	1.30	1.20	0.80	1.26	1.13	1.13	1.00	1.00	1.00	16.44	8.22	1.00	0.50	12.10	17.50
4	3.00	3.00	4.00	3.92	15.00	10.98	3.94	2.65	1.30	1.20	0.80	1.35	1.17	1.17	1.00	1.00	1.00	16.44	8.22	1.00	0.50	15.43	22.63
5	3.00	3.00	5.00	4.90	29.40	29.01	17.47	21.02	1.30	1.20	0.80	1.57	1.29	1.29	1.00	1.00	1.00	16.44	8.22	1.00	0.50	107.88	116.88
6	3.00	3.00	6.00	4.90	29.40	29.01	17.47	21.02	1.30	1.20	0.80	1.68	1.34	1.34	1.00	1.00	1.00	16.44	8.22	1.00	0.50	130.79	141.59

LOCAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	2.61	9.90	8.31	2.45	1.20	1.30	1.20	1.20	1.08	1.00	1.00	1.00	1.00	1.00	16.44	8.22	1.00	0.50	3.14	5.64
2	3.00	3.00	2.00	2.61	9.90	8.31	2.45	1.20	1.30	1.20	1.20	1.16	1.00	1.00	1.00	1.00	1.00	16.44	8.22	1.00	0.50	4.40	9.40
3	3.00	3.00	3.00	2.61	10.18	8.44	2.52	1.27	1.30	1.20	1.20	1.24	1.12	1.12	1.00	1.00	1.00	16.44	8.22	1.00	0.50	6.42	13.92
4	3.00	3.00	4.00	2.61	10.18	8.44	2.52	1.27	1.30	1.20	1.20	1.32	1.16	1.16	1.00	1.00	1.00	16.44	8.22	1.00	0.50	8.11	18.11
5	3.00	3.00	5.00	3.27	20.68	15.63	6.98	6.14	1.30	1.20	1.20	1.48	1.24	1.24	1.00	1.00	1.00	16.44	8.22	1.00	0.50	38.48	50.98
6	3.00	3.00	6.00	3.27	20.68	15.63	6.98	6.14	1.30	1.20	1.20	1.58	1.29	1.29	1.00	1.00	1.00	16.44	8.22	1.00	0.50	46.29	61.29

> As Per IS 6403 : 1981, Table - 03 Mix Shear Failure

Note:-

1) Factor of safety of 2.5 is considered.

2) The depth of foundation is considered from the NGL.

3) Ultimate net safe bearing capapcity is evaluated after taking into consideration shape factor,depth factor of foundation in accordance with IS-6403-1981.

BH-06

Calculation of Net Safe Bearing Capacity based on C - Φ parameters

As per IS-6403:1981

Project Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

GENERAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	1.96	21.40	16.48	7.59	6.93	1.30	1.20	0.80	1.10	1.05	1.05	1.00	1.00	1.00	17.90	8.95	1.00	0.50	10.91	12.71
2	3.00	3.00	2.00	1.96	21.40	16.48	7.59	6.93	1.30	1.20	0.80	1.20	1.10	1.10	1.00	1.00	1.00	17.90	8.95	1.00	0.50	18.06	21.66
3	3.00	3.00	3.00	0.00	27.00	24.49	13.76	15.49	1.30	1.20	0.80	1.33	1.16	1.16	1.00	1.00	1.00	17.90	8.95	1.00	0.50	46.89	52.29
4	3.00	3.00	4.00	0.00	27.00	24.49	13.76	15.49	1.30	1.20	0.80	1.44	1.22	1.22	1.00	1.00	1.00	17.90	8.95	1.00	0.50	62.69	69.89
5	3.00	3.00	5.00	0.00	28.10	26.56	15.46	18.02	1.30	1.20	0.80	1.56	1.28	1.28	1.00	1.00	1.00	17.90	8.95	1.00	0.50	91.03	100.03
6	3.00	3.00	6.00	0.00	28.10	26.56	15.46	18.02	1.30	1.20	0.80	1.67	1.33	1.33	1.00	1.00	1.00	17.90	8.95	1.00	0.50	111.89	122.69

LOCAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	1.31	14.71	10.83	3.86	2.57	1.30	1.20	1.20	1.09	1.04	1.04	1.00	1.00	1.00	17.90	8.95	1.00	0.50	5.19	7.69
2	3.00	3.00	2.00	1.31	14.71	10.83	3.86	2.57	1.30	1.20	1.20	1.17	1.09	1.09	1.00	1.00	1.00	17.90	8.95	1.00	0.50	8.15	13.15
3	3.00	3.00	3.00	0.00	18.85	13.94	5.83	4.76	1.30	1.20	1.20	1.28	1.14	1.14	1.00	1.00	1.00	17.90	8.95	1.00	0.50	18.05	25.55
4	3.00	3.00	4.00	0.00	18.85	13.94	5.83	4.76	1.30	1.20	1.20	1.37	1.19	1.19	1.00	1.00	1.00	17.90	8.95	1.00	0.50	23.81	33.81
5	3.00	3.00	5.00	0.00	19.68	14.59	6.24	5.22	1.30	1.20	1.20	1.47	1.24	1.24	1.00	1.00	1.00	17.90	8.95	1.00	0.50	32.65	45.15
6	3.00	3.00	6.00	0.00	19.68	14.59	6.24	5.22	1.30	1.20	1.20	1.57	1.28	1.28	1.00	1.00	1.00	17.90	8.95	1.00	0.50	39.80	54.80

> As Per IS 6403 : 1981, Table - 03 Mix Shear Failure

Note:-

1) Factor of safety of 2.5 is considered.

2) The depth of foundation is considered from the NGL.

3) Ultimate net safe bearing capapcity is evaluated after taking into consideration shape factor,depth factor of foundation in accordance with IS-6403-1981.

BH-07

Calculation of Net Safe Bearing Capacity based on C - Φ parameters

As per IS-6403:1981

Project Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

GENERAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	3.92	15.00	10.98	3.94	2.65	1.30	1.20	0.80	1.09	1.04	1.04	1.00	1.00	1.00	17.48	8.74	1.00	0.50	6.17	7.97
2	3.00	3.00	2.00	3.92	15.00	10.98	3.94	2.65	1.30	1.20	0.80	1.17	1.09	1.09	1.00	1.00	1.00	17.48	8.74	1.00	0.50	9.38	12.98
3	3.00	3.00	3.00	1.96	20.40	15.30	6.74	5.83	1.30	1.20	0.80	1.29	1.14	1.14	1.00	1.00	1.00	17.48	8.74	1.00	0.50	21.76	27.16
4	3.00	3.00	4.00	1.96	20.40	15.30	6.74	5.83	1.30	1.20	0.80	1.38	1.19	1.19	1.00	1.00	1.00	17.48	8.74	1.00	0.50	28.59	35.79
5	3.00	3.00	5.00	1.96	20.40	15.30	6.74	5.83	1.30	1.20	0.80	1.48	1.24	1.24	1.00	1.00	1.00	17.48	8.74	1.00	0.50	35.89	44.89
6	3.00	3.00	6.00	0.00	29.20	28.63	17.16	20.56	1.30	1.20	0.80	1.68	1.34	1.34	1.00	1.00	1.00	17.48	8.74	1.00	0.50	123.04	133.84

LOCAL SHEAR FAILURE

Sr No	Size of Fdn.		Depth of	Shear Parameter		Bearing capacity factors			Shape Factors			Depth Factor			Inclination Factors			Unit Weight		Water table correction		Net Safe bearing Capacity	Gross Safe bearing Capacity
	Length	Width	Fdn.	C	Φ	Nc	Nq	N_Y	Sc	Sq	S_Y	dc	dq	d_Y	ic	iq	i_Y	Y	0.5Y				
	(mt)	(mt)	(mt)	kN/m^2	degree	-	-	-	-	-	-	-	-	-	-	-	-	kN/m^3	kN/m^3	W_q	W_Y	T/m^2	T/m^2
1	3.00	3.00	1.00	2.61	10.18	8.44	2.52	1.27	1.30	1.20	1.20	1.08	1.04	1.04	1.00	1.00	1.00	17.48	8.74	1.00	0.50	3.47	5.97
2	3.00	3.00	2.00	2.61	10.18	8.44	2.52	1.27	1.30	1.20	1.20	1.16	1.08	1.08	1.00	1.00	1.00	17.48	8.74	1.00	0.50	5.05	10.05
3	3.00	3.00	3.00	1.31	13.99	10.45	3.64	2.36	1.30	1.20	1.20	1.26	1.13	1.13	1.00	1.00	1.00	17.48	8.74	1.00	0.50	10.27	17.77
4	3.00	3.00	4.00	1.31	13.99	10.45	3.64	2.36	1.30	1.20	1.20	1.34	1.17	1.17	1.00	1.00	1.00	17.48	8.74	1.00	0.50	13.34	23.34
5	3.00	3.00	5.00	1.31	13.99	10.45	3.64	2.36	1.30	1.20	1.20	1.43	1.21	1.21	1.00	1.00	1.00	17.48	8.74	1.00	0.50	16.59	29.09
6	3.00	3.00	6.00	0.00	20.53	15.45	6.85	5.97	1.30	1.20	1.20	1.58	1.29	1.29	1.00	1.00	1.00	17.48	8.74	1.00	0.50	43.63	58.63

> As Per IS 6403 : 1981, Table - 03 Mix Shear Failure

Note:-

1) Factor of safety of 2.5 is considered.

2) The depth of foundation is considered from the NGL.

3) Ultimate net safe bearing capapcity is evaluated after taking into consideration shape factor,depth factor of foundation in accordance with IS-6403-1981.

ANNEXTURE-04

Bearing Capacity based on SPT Value & Settlement Criteria

Calculation of Net Safe Bearing Capacity based on Settlement Criteria

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

Borehole No.	1

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	3	
Corrected N-Value	4	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	1.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	90	mm/T/m^2
Water Table Correction	0.5	
Settlement	180	mm
Safe Bearing Pressure	**2.8**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	3	
Corrected N-Value	4	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	2.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	80	mm/T/m^2
Water Table Correction	0.5	
Settlement	160	mm
Safe Bearing Pressure	**4.6**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	7	
Corrected N-Value	8	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	3.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	30	mm/T/m^2
Water Table Correction	0.5	
Settlement	60	mm
Safe Bearing Pressure	**8.3**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

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PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	7	
Corrected N-Value	8	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	4.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	30	mm/T/m^2
Water Table Correction	0.5	
Settlement	60	mm
Safe Bearing Pressure	**9.8**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	56	
Corrected N-Value	34	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	5.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	8	mm/T/m^2
Water Table Correction	0.5	
Settlement	16	mm
Safe Bearing Pressure	**27.5**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	56	
Corrected N-Value	34	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	6.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	8	mm/T/m^2
Water Table Correction	0.5	
Settlement	16	mm
Safe Bearing Pressure	**29.0**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

Calculation of Net Safe Bearing Capacity based on Settlement Criteria

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

Borehole No.	2

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	7	
Corrected N-Value	8	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	1.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	45	mm/T/m^2
Water Table Correction	0.5	
Settlement	90	mm
Safe Bearing Pressure	**2.9**	T/m^2

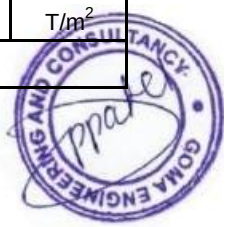
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	7	
Corrected N-Value	8	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	2.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	45	mm/T/m^2
Water Table Correction	0.5	
Settlement	90	mm
Safe Bearing Pressure	**5.6**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	7	
Corrected N-Value	8	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	3.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	45	mm/T/m^2
Water Table Correction	0.5	
Settlement	90	mm
Safe Bearing Pressure	**7.6**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.



PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	13	
Corrected N-Value	13	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	4.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	25	mm/T/m^2
Water Table Correction	0.5	
Settlement	50	mm
Safe Bearing Pressure	**10.0**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	13	
Corrected N-Value	13	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	5.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	25	mm/T/m^2
Water Table Correction	0.5	
Settlement	50	mm
Safe Bearing Pressure	**11.5**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	13	
Corrected N-Value	13	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	6.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	25	mm/T/m^2
Water Table Correction	0.5	
Settlement	50	mm
Safe Bearing Pressure	**12.7**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

Calculation of Net Safe Bearing Capacity based on Settlement Criteria

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

Borehole No.	3

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	4	
Corrected N-Value	5	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	1.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	85	mm/T/m^2
Water Table Correction	0.5	
Settlement	170	mm
Safe Bearing Pressure	**2.9**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	4	
Corrected N-Value	5	
Width of Foundation (W)	1.5	m
Depth of Foundation (D)	2.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	85	mm/T/m^2
Water Table Correction	0.5	
Settlement	170	mm
Safe Bearing Pressure	**3.7**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	12	
Corrected N-Value	13	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	3.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	25	mm/T/m^2
Water Table Correction	0.5	
Settlement	50	mm
Safe Bearing Pressure	**10.0**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

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PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	12	
Corrected N-Value	13	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	4.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	25	mm/T/m^2
Water Table Correction	0.5	
Settlement	50	mm
Safe Bearing Pressure	**10.0**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	39	
Corrected N-Value	27	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	5.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	9	mm/T/m^2
Water Table Correction	0.5	
Settlement	18	mm
Safe Bearing Pressure	**26.3**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	39	
Corrected N-Value	27	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	6.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	9	mm/T/m^2
Water Table Correction	0.5	
Settlement	18	mm
Safe Bearing Pressure	**27.8**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

Calculation of Net Safe Bearing Capacity based on Settlement Criteria

Project:- Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

Borehole No.	4

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	6	
Corrected N-Value	7	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	1.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	50	mm/T/m^2
Water Table Correction	0.5	
Settlement	100	mm
Safe Bearing Pressure	**5.0**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	6	
Corrected N-Value	7	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	2.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	45	mm/T/m^2
Water Table Correction	0.5	
Settlement	90	mm
Safe Bearing Pressure	**5.6**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	6	
Corrected N-Value	7	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	3.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	40	mm/T/m^2
Water Table Correction	0.5	
Settlement	80	mm
Safe Bearing Pressure	**8.0**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

GOA ENGINEERING AND CONSULTANCY

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	11	
Corrected N-Value	12	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	4.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	20	mm/T/m^2
Water Table Correction	0.5	
Settlement	40	mm
Safe Bearing Pressure	**12.5**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	19	
Corrected N-Value	17	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	5.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	15	mm/T/m^2
Water Table Correction	0.5	
Settlement	30	mm
Safe Bearing Pressure	**15.2**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	19	
Corrected N-Value	17	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	6.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	15	mm/T/m^2
Water Table Correction	0.5	
Settlement	30	mm
Safe Bearing Pressure	**16.7**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

Calculation of Net Safe Bearing Capacity based on Settlement Criteria

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

Borehole No.	5

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	4	
Corrected N-Value	6	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	1.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	80	mm/T/m^2
Water Table Correction	0.5	
Settlement	160	mm
Safe Bearing Pressure	**3.1**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	4	
Corrected N-Value	6	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	2.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	80	mm/T/m^2
Water Table Correction	0.5	
Settlement	160	mm
Safe Bearing Pressure	**3.9**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	12	
Corrected N-Value	13	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	3.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	20	mm/T/m^2
Water Table Correction	0.5	
Settlement	40	mm
Safe Bearing Pressure	**10.3**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

GOA ENGINEERING AND CONSULTANCY

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	12	
Corrected N-Value	13	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	4.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	20	mm/T/m^2
Water Table Correction	0.5	
Settlement	40	mm
Safe Bearing Pressure	**11.8**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	29	
Corrected N-Value	22	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	5.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	12	mm/T/m^2
Water Table Correction	0.5	
Settlement	24	mm
Safe Bearing Pressure	**19.3**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	29	
Corrected N-Value	22	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	6.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	12	mm/T/m^2
Water Table Correction	0.5	
Settlement	24	mm
Safe Bearing Pressure	**20.8**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

GOMA ENGINEERING AND CONSULTANCY

Calculation of Net Safe Bearing Capacity based on Settlement Criteria

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

Borehole No.	6

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	13	
Corrected N-Value	15	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	1.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	25	mm/T/m^2
Water Table Correction	0.5	
Settlement	50	mm
Safe Bearing Pressure	**7.0**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	13	
Corrected N-Value	15	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	2.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	25	mm/T/m^2
Water Table Correction	0.5	
Settlement	50	mm
Safe Bearing Pressure	**8.0**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	13	
Corrected N-Value	15	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	3.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	20	mm/T/m^2
Water Table Correction	0.5	
Settlement	40	mm
Safe Bearing Pressure	**12.5**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

GOA ENGINEERING AND CONSULTANCY

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	13	
Corrected N-Value	15	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	4.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	20	mm/T/m^2
Water Table Correction	0.5	
Settlement	40	mm
Safe Bearing Pressure	**14.0**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	43	
Corrected N-Value	29	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	5.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	9	mm/T/m^2
Water Table Correction	0.5	
Settlement	18	mm
Safe Bearing Pressure	**24.8**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	43	
Corrected N-Value	29	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	6.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	9	mm/T/m^2
Water Table Correction	0.5	
Settlement	18	mm
Safe Bearing Pressure	**27.8**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

GOMA ENGINEERING AND CONSULTANCY

Calculation of Net Safe Bearing Capacity based on Settlement Criteria

Project:-	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera, Gujarat.

Borehole No.	7

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	5	
Corrected N-Value	7	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	1.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	50	mm/T/m^2
Water Table Correction	0.5	
Settlement	100	mm
Safe Bearing Pressure	**5.0**	T/m^2

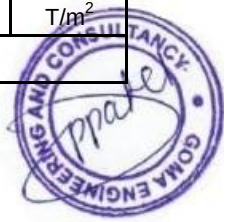
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	5	
Corrected N-Value	7	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	2.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	50	mm/T/m^2
Water Table Correction	0.5	
Settlement	100	mm
Safe Bearing Pressure	**6.5**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	39	
Corrected N-Value	29	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	3.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	8.5	mm/T/m^2
Water Table Correction	0.5	
Settlement	17	mm
Safe Bearing Pressure	**26.4**	T/m^2

Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.



PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	39	
Corrected N-Value	29	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	4.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	8.5	mm/T/m^2
Water Table Correction	0.5	
Settlement	17	mm
Safe Bearing Pressure	**27.9**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	39	
Corrected N-Value	29	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	5.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	8.5	mm/T/m^2
Water Table Correction	0.5	
Settlement	17	mm
Safe Bearing Pressure	**29.4**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

PARAMETER	VALUE	UNIT
Permissible Settelement	50	mm
N-Value	39	
Corrected N-Value	29	
Width of Foundation (W)	3.0	m
Depth of Foundation (D)	6.0	m
As per IS-8009(Part-I)-1976 from Fig.09		
Unit Settlement for 10 T/m2	8.5	mm/T/m^2
Water Table Correction	0.5	
Settlement	17	mm
Safe Bearing Pressure	**29.4**	T/m^2
Note: Calculation of Settlement and Capacity based on IS:8009(Part I)-1976.		

GOMA ENGINEERING AND CONSULTANCY

ANNEXTURE-05

Laboratory Calculation and Borelog

Project		Bore hole/Test pit		Drilling		Logo
Name:	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera	Name:	BH-01	Contractor:		GOMA ENGINEERING AND CONSULTANCY
Client:	KECL Ahmedabad.	Depth [m]:	10	Method:	Rotary drilling	
Location:	Dholera, Gujarat.	Elevation [m]:	-	Start date:		
Code:	GS-005-1088-SBC-2022	Water table level [m]:	1.9	End date:		

Depth [m]	GWT [m]	Sample Type	USCS	Description	SPT (Blows per 30 cm)	Soil Particles: Gravel [%]	Sand [%]	Silt [%]	Clay [%]	Atterberg Limits: LL [%]	PL [%]	PI [%]	Physical Characteristics: g d [g/cm³]	w [%]	G s	Direct Shear Test: Type	phi [deg.]	c [kg/cm²]	q u [kg/cm²]	Triaxial Compression: Type	phi [deg.]	c [kg/cm²]	phi' [deg.]	c' [kg/cm²]	Consolidation: C c	C s	p' c [kg/cm²]	Other Tests	Elevation [m]
0						0	2.1	97.9	-																			0
1				SILTY CLAY																								-1
2		SS			3	0.4	3.5	96.1	-																			-2
3		SH		SILT		0	3.1	96.9	-	NP	NP	NP	1.54	14.1	2.46	F	21.2	0.02										-3
4																												-4
5		SS			7	0	0.7	99.3	-	NP	NP	NP																-5
6		SH		Silty SAND		0.1	53.8	46.1	-	NP	NP	NP	1.43	18.9	2.59	F	25.3	0										-6
7		SS			56	0	82.7	17.3	-	NP	NP	NP																-7
8																												-8
9						0	68.2	31.8	-	NP	NP	NP				F	27	0										-9
10		SS		SILT	50	3.4	2.1	94.5		NP	NP	NP																-10
				End of boring																								

Sample
- Disturbed
- Undisturbed
- Rock core

Index
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- Gs: Specific Gravity

Strength & Compression
- F: Fast
- S: Slow
- phi, phi': Friction angle
- c, c': Cohesion
- CD: Consolidated Drained
- CU: Consolidated Undrained
- UU: Unconsolidated Undrained
- qu: Unconfined Compression
- Cc: Coefficient of compression
- Cs: Coefficient of swelling

Other tests
- CH: Chemical
- CMP: Compaction
- PLT: Plate loading test
- K: Permeability

Note:

Full details available in supplementary legend.

Project		Bore hole/Test pit		Drilling		Logo
Name:	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera	Name:	BH-02	Contractor:		GOMA ENGINEERING AND CONSULTANCY
Client:	KECL Ahmedabad.	Depth [m]:	10	Method:	Rotary drilling	
Location:	Dholera, Gujarat.	Elevation [m]:	-	Start date:		
Code:	GS-005-1088-SBC-2022	Water table level [m]:	2.1	End date:		

Depth [m]	GWT [m]	Sample Type	USCS	Description	SPT (Blows per 30 cm)	Soil Particles: Gravel [%]	Sand [%]	Silt [%]	Clay [%]	Atterberg Limits: LL [%]	PL [%]	PI [%]	Physical Characteristics: g d [g/cm³]	w [%]	G s	Direct Shear Test: Type	phi [deg.]	c [kg/cm²]	q u [kg/cm²]	Triaxial Compression: Type	phi [deg.]	c [kg/cm²]	phi' [deg.]	c' [kg/cm²]	Consolidation: C c	C s	p' c [kg/cm²]	Other Tests	Elevation [m]
0				SILTY CLAY		0	5.1	94.9	-																			0
1		SH		FAT CLAY		0.2	4.3	95.5	-	64.5	27.4	37.1	1.59	11.9		F	16.2	0.03										-1
2																												-2
3		SS		SILTY CLAY	6	0	8	92	-																			-3
4		SH		Clayey SAND		2.1	59.9	38	-	32.5	20.3	12.2	1.51	16.7	2.49	F	21.9	0.02										-4
5																												-5
6		SS		Sandy SILT	13	0.3	49	50.7	-	NP	NP	NP																-6
7																												-7
8		SH		Silty SAND		0.1	53	46.9	-	NP	NP	NP	1.53	13	2.56	F	26.1	0										-8
9		SS		SILT	33	0	8.1	91.9	-	NP	NP	NP																-9
10				Silty SAND		0	82.4	17.6	-	NP	NP	NP																-10
				End of boring																								

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Note:

Full details available in supplementary legend.

Project		Bore hole/Test pit		Drilling		Logo
Name:	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera	Name:	BH-03	Contractor:		GOMA ENGINEERING AND CONSULTANCY
Client:	KECL Ahmedabad.	Depth [m]:	10	Method:	Rotary drilling	
Location:	Dholera, Gujarat.	Elevation [m]:	-	Start date:		
Code:	GS-005-1088-SBC-2022	Water table level [m]:	1.8	End date:		

Depth [m]	GWT [m]	Sample Type	USCS	Description	SPT (Blows per 30 cm)	Soil Particles: Gravel [%]	Sand [%]	Silt [%]	Clay [%]	Atterberg Limits: LL [%]	PL [%]	PI [%]	Physical Characteristics: g d [g/cm³]	w [%]	G s	Direct Shear Test: Type	phi [deg.]	c [kg/cm²]	q u [kg/cm²]	Triaxial Compression: Type	phi [deg.]	c [kg/cm²]	phi' [deg.]	c' [kg/cm²]	Consolidation: C c	C s	p' c [kg/cm²]	Other Tests	Elevation [m]
0				SILTY CLAY		1	3	96	-																			0
1		SS		Silty SAND	4	0	73.1	26.9	-	NP	NP	NP																-1
2																												-2
3				LEAN CLAY		0	2.3	97.7	-	36.5	22	14.5			2.54	F	12.4	0.04										-3
4		SS		Silty SAND	12	0.1	50.3	49.6	-																			-4
5																												-5
6		SS		Sandy SILT	39	0	42.9	57.1	-							F	25.9	0										-6
7		SS		SILTY CLAY with Sand	51	0	29.5	70.5	-																			-7
8																												-8
9		SS		Silty SAND	62	0	66.8	33.2	-	NP	NP	NP				F	28	0										-9
10		SS		End of boring	72	0	71.4	28.6	-	NP	NP	NP																-10

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- Cs: Coefficient of swelling

Other tests
- CH: Chemical
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- K: Permeability

Note:
Full details available in supplementary legend.

Project		Bore hole/Test pit		Drilling		Logo
Name:	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera	Name:	BH-04	Contractor:		GOMA ENGINEERING AND CONSULTANCY
Client:	KECL Ahmedabad.	Depth [m]:	10	Method:	Rotary drilling	
Location:	Dholera, Gujarat.	Elevation [m]:	-	Start date:		
Code:	GS-005-1088-SBC-2022	Water table level [m]:	2	End date:		

Depth [m]	GWT [m]	Sample Type	USCS	Description	SPT (Blows per 30 cm)	Soil Particles: Gravel [%]	Sand [%]	Silt [%]	Clay [%]	Atterberg Limits: LL [%]	PL [%]	PI [%]	Physical Characteristics: g d [g/cm³]	w [%]	G s	Direct Shear Test: Type	phi [deg.]	c [kg/cm²]	q u [kg/cm²]	Triaxial Compression: Type	phi [deg.]	c [kg/cm²]	phi' [deg.]	c' [kg/cm²]	Consolidation: C c	C s	p' c [kg/cm²]	Other Tests	Elevation [m]
0						3.6	8.4	88	-																				0
1				LEAN CLAY																									-1
2	▼					0	9.7	90.3	-	43.8	20.3	23.5	1.42	17.4	2.6	F	13.5	0.04										-2
3		SS		SILTY CLAY	6	0.6	14.2	85.2	-																			-3
4																												-4
5		SS			11	0	10.8	89.2	-							F	19.4	0.02										-5
6		SS		Silty SAND	19	0	71.4	28.6	-	NP	NP	NP																-6
7																												-7
8		SS			25	0	60.2	39.8	-	NP	NP	NP				F	27.2	0										-8
9		SS			31	0	80.2	19.8	-	NP	NP	NP																-9
10		SS		End of boring	59	0	82	18	-	NP	NP	NP																-10

Sample
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Index
- LL: Liquid Limit
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- PI: Plastic Index
- NP: Non-Plastic
- gd: Dry unit weight
- w: Moisture Content
- Gs: Specific Gravity

Strength & Compression
- F: Fast
- S: Slow
- phi, phi': Friction angle
- c, c': Cohesion
- CD: Consolidated Drained
- CU: Consolidated Undrained
- UU: Unconsolidated Undrained
- qu: Unconfined Compression
- Cc: Coefficient of compression
- Cs: Coefficient of swelling

Other tests
- CH: Chemical
- CMP: Compaction
- PLT: Plate loading test
- K: Permeability

Note:

Full details available in supplementary legend.

Project		Bore hole/Test pit		Drilling		Logo
Name:	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera	Name:	BH-05	Contractor:		GOMA ENGINEERING AND CONSULTANCY
Client:	KECL Ahmedabad.	Depth [m]:	10	Method:	Rotary drilling	
Location:	Dholera, Gujarat.	Elevation [m]:	-	Start date:		
Code:	GS-005-1088-SBC-2022	Water table level [m]:	2.3	End date:		

Depth [m]	GWT [m]	Sample Type	USCS	Description	SPT (Blows per 30 cm)	Soil Particles: Gravel [%]	Sand [%]	Silt [%]	Clay [%]	Atterberg Limits: LL [%]	PL [%]	PI [%]	Physical Characteristics: g d [g/cm³]	w [%]	G s	Direct Shear Test: Type	phi [deg.]	c [kg/cm²]	q u [kg/cm²]	Triaxial Compression: Type	phi [deg.]	c [kg/cm²]	phi' [deg.]	c' [kg/cm²]	Consolidation: C c	C s	p' c [kg/cm²]	Other Tests	Elevation [m]
0				SILTY CLAY		6.8	5	88.2	-																				0
1		SS		Sandy SILTY CLAY	4	0	30.1	69.9	-																				-1
2																													-2
3		SH		LEAN CLAY		0.1	2.8	97.1	-	49.8	20.8	29	1.37	22.4	2.37	F	14.6	0.04											-3
4																													-4
5		SS			12	0	13	87	-																				-5
6																													-6
7		SS			19	0.1	6.4	93.5	-							F	15	0.04											-7
8				SILTY CLAY																									-8
9		SS		Silty SAND	47	0	3.2	96.8	-																				-9
10																													-10
		SS		End of boring	48	0	67.1	32.9	-	NP	NP	NP				F	29.4	0										
					59	0	77.3	22.7	-	NP	NP	NP																	

Sample
- Disturbed
- Undisturbed
- Rock core

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Note:

Full details available in supplementary legend.

Project		Bore hole/Test pit		Drilling		Logo
Name:	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera	Name:	BH-06	Contractor:		GOMA ENGINEERING AND CONSULTANCY
Client:	KECL Ahmedabad.	Depth [m]:	10	Method:	Rotary drilling	
Location:	Dholera, Gujarat.	Elevation [m]:	-	Start date:		
Code:	GS-005-1088-SBC-2022	Water table level [m]:	2	End date:		

Depth [m]	GWT [m]	Sample Type	USCS	Description	SPT (Blows per 30 cm)	Soil Particles: Gravel [%]	Sand [%]	Silt [%]	Clay [%]	Atterberg Limits: LL [%]	PL [%]	PI [%]	Physical Characteristics: g d [g/cm³]	w [%]	G s	Direct Shear Test: Type	phi [deg.]	c [kg/cm²]	q u [kg/cm²]	Triaxial Compression: Type	phi [deg.]	c [kg/cm²]	phi' [deg.]	c' [kg/cm²]	Consolidation: C c	C s	p' c [kg/cm²]	Other Tests	Elevation [m]
0						0.6	6.4	93	-																				0
1				SILTY CLAY																									-1
2	▼	SH				0	5.2	94.8	-				1.52	17.8		F	21.4	0.02											-2
3		SS			13	0	72.4	27.6	-	NP	NP	NP																	-3
4				Silty SAND																									-4
5		SH				0.4	65.5	34.1	-	NP	NP	NP	1.58	19.2	2.45	F	27	0											-5
6		SS			43	0	86.3	13.7	-	NP	NP	NP																	-6
7																													-7
8		SH		Silty, Clayey SAND		0	60.2	39.8	-				1.47	22.4	2.54	F	28.1	0											-8
9		SS			65	0.5	67.6	31.9	-																				-9
10		SS			83	0	63	37																					-10
				End of boring																									

Sample
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Note:
Full details available in supplementary legend.

Project		Bore hole/Test pit		Drilling		Logo
Name:	Geotechnical Investigation for Construction of Culvert Structure over River near Dholera	Name:	BH-07	Contractor:		GOMA ENGINEERING AND CONSULTANCY
Client:	KECL Ahmedabad.	Depth [m]:	10	Method:	Rotary drilling	
Location:	Dholera, Gujarat.	Elevation [m]:	-	Start date:		
Code:	GS-005-1088-SBC-2022	Water table level [m]:	1.9	End date:		

Depth [m]	GWT [m]	Sample Type	USCS	Description	SPT (Blows per 30 cm)	Soil Particles: Gravel [%]	Sand [%]	Silt [%]	Clay [%]	Atterberg Limits: LL [%]	PL [%]	PI [%]	Physical Characteristics: g d [g/cm³]	w [%]	G s	Direct Shear Test: Type	phi [deg.]	c [kg/cm²]	q u [kg/cm²]	Triaxial Compression: Type	phi [deg.]	c [kg/cm²]	phi' [deg.]	c' [kg/cm²]	Consolidation: C c	C s	p' c [kg/cm²]	Other Tests	Elevation [m]
0				SILTY CLAY		0.2	4.9	94.9	-																				0
1		SS		Sandy SILT	5	0	44.7	55.3	-	NP	NP	NP																	-1
2																													-2
3		SH		FAT CLAY		0.6	3.8	95.6	-	52.5	22.9	29.6	1.34	24.1		F	15	0.04											-3
4		SS		Silty, Clayey SAND	39	0	66.8	33.2	-																				-4
5																													-5
6		SH		SILT		0	6.8	93.2	-	NP	NP	NP	1.36	28.5	2.44	F	20.4	0.02											-6
7		SS		Sandy SILTY CLAY	53	0	38.5	61.5	-																				-7
8																													-8
9		SS		Silty SAND	54	0.1	64.6	35.3	-	NP	NP	NP				F	29.2	0											-9
10		SS			84	0	65.2	34.8	-	NP	NP	NP																	-10
				End of boring																									

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Note:

Full details available in supplementary legend.

Soil Office SO-Log

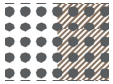
Boring log legend

Patterns

Gravel


GW


GW-GC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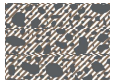
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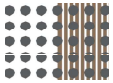
GP


GW-GM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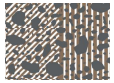
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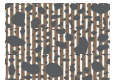
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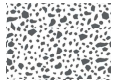
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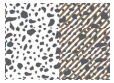
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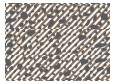
SP-SC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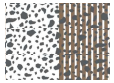
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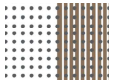
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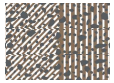
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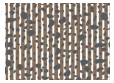
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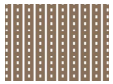
Fines


CL


CH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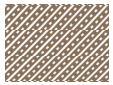
PT


CL-ML


MH

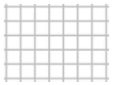

OH


ML

Rock & Others


ROCK


TS


OTHER

HWR


FL

Sample types

Disturbed

BU: Bulk — SS: Split-spoon

Undisturbed

BL: Block — FO: Foil — PT: Pitcher

CC: Core cutter — PH: Hydraulic piston — SH: Shelby

D: Denison — PS: Stationary piston

Rock core

ST: Single tube — TT: Triple tube

DT: Double tube — WL: Wire line

Symbols & Abbreviations

Index

G: Gravel — LL: Liquid limit — g_d: Dry unit weight

S: Sand — PL: Plastic limit — w: Moisture content

M: Silt — PI: Plastic index — G_s: Specific gravity

C: Clay — NP: Non-plastic

Strength

F: Fast — CD: Consolidated Drained

S: Slow — CU: Consolidated Undrained

phi, phi': Friction Angle — UU: Unconsolidated Undrained

c, c': Cohesion — q_u: Unconfined compression

Compression

C_c: Coefficient of compression — C_s: Coefficient of swelling

Other tests

CH: Chemical — PLT: Plate Loading Test

CMP: Compaction — K: Permeability

ANNEXTURE-06

Photograph of Investigation

GOMA ENGINEERING AND CONSULTANCY

GOMA ENGINEERING AND CONSULTANCY

GOMA ENGINEERING AND CONSULTANCY

**** END OF REPORT****